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Structural requirements necessary for the implementation of a successful Marine Protected Area (MPA) in the Ross Sea

and associated management issues

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Executive Summary

The Ross Sea is an ecologically important area, providing habitat to a unique range of species assemblages which are endemic to the region. The area is not only a major marine ecosystem, but also one of the world's most pristine and least affected continental shelf/slopes on the planet, hence conservation of the Ross Sea is of high importance. In December 2017, the establishment of the Ross Sea Marine Protected Area (MPA) was recognised to protect and conserve the ecosystem. A review of the existing management plan, the Conservation Measure 91-05, and provisions for the Ross Sea (MPA) was conducted. Structural requirements necessary for a successful MPA was researched, looking at other MPAs and their approach, management plans and success. What defines a 'successful' MPA was reviewed, aimed to provide scientific basis and a 'checklist' approach to evaluate the effectiveness of the Ross Sea MPA. This included current monitoring recommendations, and further suggestions for management. Research included looking at proposed methods for obtaining ongoing monitoring data (such as the toothfish tagging programme, catches reported) and how these results will be used and contributed to the ongoing support of the MPA. Further research will include looking at other MPAs in the Antarctic and Southern Ocean and what monitoring programs have been implemented.

Introduction

The Ross Sea is an ecologically important area, providing habitat to a unique range of species assemblages (Ballard et al 2012). It is home to an endemic species of Killer whales, Adelie and Emperor penguins, Antarctic Minke whales, Weddell seals and Antarctic petrels (Clarke and Johnston 2003). It also hosts a rich variety of benthos, comprised of five major community types making it a benthic biodiversity hotspot (Clarke and Johnston 2003). The area is hence not only a major marine ecosystem, but also one of the world's most pristine and least affected continental shelf/slopes on the planet (Halpern et al. 2008). Conservation and protection of the area was therefore put forward by a joint New Zealand/United States proposal within the 25-member Commission for the Conservation of Marine Living Resources (CCAMLR). On December 1st 2017, the Ross Sea gained recognition of the world's largest Marine Protected Area for a course of 35 years.

The endemism found within this area is of high conservation importance. Despite the newly recognised MPA being a significant achievement for the major contribution to global marine protection, scientific research and monitoring to assess the efficiency of the development of the MPA is of high priority. As the Ross Sea is in international waters, difficulties in management may arise due to disagreements with the level of 'strictness' of measures from different countries. Furthermore, will regulations be adhered to over the 35 duration of the MPA by all Member countries of CCAMLR? The aim of this project is to provide a review of the current Conservation Measure 91- 05 (2016), the assessment and evaluation of the MPA, and the collaboration encouraged between the Member States.

The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR)

Why was CCAMLR established?

In the mid-1970s, exploitation of Antarctic marine living resource increased so rapidly that several species of fish were severely depleted (Miller *et al.* 2004). This lead to the increasing concern that unsustainable fishing practices may impact the decline of species such as Antarctic krill which are extremely important trophic components of Antarctic ecosystems (Mitchell and Sandbrook 1980). With motivation provided by the Third United Nations Conference on the Law of the Sea (UNCLOS— III) negotiations, these concerns encouraged the 1975 Eighth Antarctic Treaty Consultative Meeting (ATCM) to consider marine living resource conservation in the context of Treaty Article IX (Miller *et al.* 2004). Consequently, the Convention entered into force on 7 April 1982 and there are currently 36 Contracting Parties in which 25 of which are Commission Members under Article VII of the Antarctic Treaty (Miller *et al.* 2004).

What do CCAMLR do?

CCAMLR is the arm of the Antarctic Treaty System that is responsible for the governance of the use of marine life in the Southern Ocean surrounding Antarctica. The Souther Ocean is considered the healthiest marine ecosystem on Earth, and CCAMLR has dedicated MPAs around the waters of Antarctica to help protect and conserve the ecosystems found here (Brooks *et al.* 2016). Antarctica is facing rapid changes that can cause potential impacts on a global scale (Brooks *et al.* 2016). Impacts such as sea level rise, alterations in ocean circulation and climate regulation may occur due to the highly dynamic Antarctic

environment such as driving local changes in ice cover, shifts in population distributions, changes in trophic levels and primary productivity in ecosystems (Brooks *et al.* 2016). Ice dependent Antarctic krill, which are a keystone species in the Antarctic food web as they provide a food source for various predators both directly and indirectly, are potentially causing trophic cascades throughout the ecosystem. The two main threats the species is facing is loss of sea ice, as they primarily feed on the ice algae that grow underneath, and Antarctic krill fishery.

CCAMLR's primary objective is the conservation of marine living resources, however, it includes the goal of 'rational use' which allows certain fishing activities by CCAMLR's 25 Member States. Fishing practices are only allowed under specific conservation principles of precautionary, ecosystem-based management, in which the decisions are required via a consensus, and that management recognises the best available scientific information as determined by CCAMLR's Scientific Committee (an advisory body of international scientists) (Brooks *et al.* 2016). Commercial fishing is only allowed in certain regions of the Ross Sea in which CCAMLR has established scientifically grounded rules through a consensus, such as total allowable catch (Brooks *et al.* 2016). Almost half of the CCAMLR area is closed to fishing on a year-to-year basis due to lack of data to support fishing, conservation rules to conserve and protect benthic species, lack of fish stock levels and the sea ice extent (Brooks *et al.* 2016).

Despite the fact the CCAMLR permits fishing in a MPA, their forefront goal is conservation. CCAMLR functions in ecological boundaries as opposed to political, in which it manages a distinct ecosystem in best practice, successfully exceeding other regional fisheries management organisations (Brooks *et al.* 2016). CCAMLR's success includes the implentation of the management of Antarctic krill (*Euphasia superba*) which involves managing precuationary catch limits and monitoring the effects of krill predators (Brooks *et al.* 2016). Furthermore, CCAMLR aims to drastically reduce illegal, unregulated and unreported fishing in the Southern Ocean (Brooks *et al.* 2016). In accordance with this management leadership, in 2002, CCAMLR designated a network of MPA's in the Southern Ocean (Brooks *et al.* 2016). Marine Protected Areas are widely recognised tools that are invaluable in the assessment, management and mitigation of negative anthropogenic impacts, and furthermore the maintenance and conservation of biodiversity (Brooks *et al.* 2016). CCAMLR scientists identified priority areas for protection and Commission States assigned that the establishment of MPA's must be based on the best available science to protect key ecosystem processed, haibtats and biodiversity (Brooks *et al.* 2016). This involved the inclusion of scientific reference areas to monitor long term effects of fishing and climate change (Brooks *et al.* 2016). Since the establishment of CCAMLR, the Commission has created a wide-ranging collection of Conservation Measures which utilise various fishery management approaches and were developed to include environmental concerns emphasised by the Convention (Miller *et al.* 2004). The specific Measure this review aims to explore is Conservation Measure (CM) 91-05 *(Ross Sea Region Marine Protected Area, SSRU 88.2 A, SSRU 88.2 B, Subarea 88.1 All Species*)(CM 91-05, 2016) which will be kept under constant review to evaluate the effectiveness of the Ross Sea MPA (Miller *et al.* 2004).

Limitations

However, on the contrary, conflict involved in MPAs has resulted in CCAMLR Member States to ignore the best available science, misrepresent the foundational rules of the Convention and threaten the integrity of one of the worlds most recognised science based multinational governance efforts (Brooks *et al.* 2016). Negotiations at the October 2017 CCAMLR meeting offered reccomendations to implement effective MPA's in the Southern Ocean, maintaining CCAMLR's global leadership in ecosystem based management (Brooks *et al.* 2016).

Current MPA proposals only prohibit fishing in 3.2% of CCAMLR's waters for a fixed period of time, however consenus is lacking (Brooks *et al.* 2016). Past conservation success in CCAMLR has relied on open political windows of opportunity, Commission trust and an arrangement of motivations among Member States, however currently, States have become fixed in their positions for or against MPAs breaking trust (Brooks *et al.* 2016). Other States have objected that MPAs and fishing activities should be mutually exclusive (Brooks *et al.* 2016).

The ambiguity of 'rational use'

'Rational use' is defined in the Convention as a "mandate to employ precaution in resource exploitation, a critical part of conservation" (Brooks *et al.* 2016). Rational use has become ambigous in definition and been misinterpreted by several States to defend an explicit right to fish and to argue against MPAs that in any way restrict fishing access (Brooks *et al.* 2016).

Despite CCAMLR's history with precautionary management of prohibiting fishing unless sufficient data was available to manage a fishery, MPA adversaries are withdrawing the proof, demanding that sufficient data must be available to show that fishing is damaging the ecosystem to warrant an MPA that limits fishing (Brooks *et al.* 2016). If the current amended proposals are approved, their concern will alter and compromise MPA effectiveness and success, hence leading to discouragement of the conservation of CCAMLR and the implementation of science based marine management (Brooks *et al.* 2016).

The Ross Sea has the largest known high seas population of toothfish and given the continued uncertainty concerning their life history, ecosystem role and population dynamics, especially in a changing environment, CCAMLR face a vital need to establish ecosystem based management for the species (Dodds *et al*. 2017) However, the rise in CCAMLR fishing States has likely contributed to the increase of toothfish fisheries, which has caused potential challenges for maintaining 'rational use' (Dodds *et al.* 2017) CCAMLR define rational use as 'wise use', that keeps for future present and future users of the resource, and furthermore, CCAMLR states that 'conservation' includes rational use (Dodds *et al*. 2017). However, over the period of 1982 to now, there have been many misinterpretations and ambiguities relating to what is 'rational' without threatening conservation (Dodds *et al*. 2017)

MPAS as a tool for ecosystem management

Limiting and prohibiting human exploitation of marine resources has increasingly become a valuable tool in promoting long term health and sustainability of marine ecosystems (Dodds *et al.* 2017). For an effective MPA, specifically in areas of high uncertainty or risk, MPAs must be large enough to protect ecological processes and the life histories of animals found

within that area (Dodds *et al.* 2017). In addition to the size of the MPA, the design and zoning of a MPA is also important to consider, as levels of biodiversity, indicator species and trophically important species may have specific habitats. Given that the Southern Ocean is an area that experiences one of the most rapidly changing marine environments on the planet, a well designed MPA can aim to expose the impacts of and recognize potential species responses to climate change (Dodds *et al.* 2017). CCAMLR has always considered MPAs an important tool for engaging ecosystem- based management, however, the Convention specifies " the designation of the opening and closing of areas, regions or for an MPA, key areas of high species biomass and diversity were excluded so as not to interfere with current and prospecting fishing (Dodds *et al.* 2017)." This statement hence caused the following issues:

- "problematic example for the establishment of meaningful MPAs elsewhere within the CCAMLR area,
- three MPA proposals were tabled in 2012, collectively amounting to more than four million square kilometres, but thus far the Commission has failed to agree on any of them,
- one of the proposed MPAs, designed to protect the biota (for scientific study) around collapsing ice shelves, thus providing new habitat along the Antarctic Peninsula (put forward by the UK) was retracted in 2012
- the two others, one in the Ross Sea (US and NZ) and that proposing protection of several areas off East Antarctica (originally submitted by Australia, France and European Union later) were proposed to protect biodiversity, as well as the structure and function of regional ecosystems- they include reference areas to gauge the impact of climate change and fishing on ecosystem change, none included closure of current primary fishing areas,
- despite extensive negotiations during 2012-2015, CCAMLR has failed to adopt any further MPA's. While the south Orkneys MPA was laid out so that it provided no threat to fishing, the MPA in the East Antarctic and the Ross Sea would still allow current and possible future fisheries.
- in an institution where fishing states now significantly outnumber non fishing states, reaching consensus to limit fishing anywhere in the high seas portion of the Convention has proved challenging.
- according to the Food and Agriculture Organisation (FAO), almost 40% of Antarctic fisheries are underdeveloped, while across the global oceans, almost 90 % of stocks are fully or over exploited.
- CCAMLR Secretariat has even promoted Southern Ocean fisheries as a sustainable global food source.
- any of the MPA proponents, including France, Australia and the UK have Exclusive Economic Zones (EEZ) (and associated MPAs) within the CCAMLR area. These states currently deliver the largest quantity of toothfish to the market and some like France and Australia, fish almost exclusively in their sub Antarctic EEZ. The declaration of EEZs that harbour large stocks of toothfish within what would otherwise be the high seas create political tension that rises to the surface during discussion over MPAs,

- two thirds of the 15,000 t of toothfish caught in the CCAMLR area comes from the EEZs. The majority of CCAMLRs non EEZ (or high seas) catches come from the Ross Sea with a total allowable catch (TAC) of about 3,500 t per year,
- the remaining high seas toothfish fisheries scattered throughout Areas 58 and 48 only allow for approximately 1000 t catches in total,
- CCAMLR states without access to the EEZs are forced to compete in the Ross Sea and to a lesser extent in these other small toothfish fisheries,
- proposing an MPA that has boundaries aligning with another country claim has raised concern, as the joint NZ and US MPA having boundaries aligning with NZ claim of the Ross Dependency,
- NZ current plan also includes the Balleny islands which NZ in 1999 unsuccessfully tried to turn into an Antarctic Specially Managed Area with a sizeable associated marine area included,
- some members viewed this as an effort to strengthen its claim and control access to fisheries in the Ross Sea, in that it happened shortly after NZ initiated the fishery there. NZ also has legislation for the establishment of an EEZ in the Ross Sea, but it is written is such a way that it would only come into play if the ATS disintegrated (Dodds et al. 2017, Brooks *et al.* 2016)."

Antarctic biodiversity in the Ross Sea

The Ross Sea is an ecologically important area, providing habitat to a unique range of species assemblages (Ballard et al 2012). It is home to an endemic species of Type-C Ross Sea killer whales, 38% of Adélie penguins, 26% of Emperor penguins, 30% of Antarctic petrels, 6% of Antarctic Minke whales, and ~45% of Pacific sector Weddell seals (Clarke and Johnston 2003). It also hosts a rich variety of benthos, comprised of five major community types making it a benthic biodiversity hotspot (Clarke and Johnston 2003). Seven species of fish are endemic, and > 40 species of invertebrates have so far been found nowhere else as well as rare genetic strains of Weddell seals and Adélie penguins (Donnelly et al 2004; Eastman and Hubold 1999).

Fishing in the MPA

Despite the common assumption that a marine protected area would prohibit all fishing and disruption to species, the Ross Sea MPA was established by CCAMLR, who is responsible for the conservation of marine living resources while maintaining economic fisheries, so the rules and regulations are a little more complex. The fisheries in the Convention Area currently include the Patagonian toothfish (*Dissostichus eleginoides*), Antarctic toothfish (*Dissostichus mawsoni*), mackerel icefish (*Champsocephalus gunnari*) and Antarctic krill (*Euphausia superba*) (CCAMLR, 2018). These fisheries are managed using an ecosystem based precautionary approach, recognising the balance of conservation and rational use of resources and maintaining ecological functions and relationships (CCAMLR, 2018). Total catch limits in each fishery are established via decision rules to protect the long term sustainability of the fishery (CCAMLR, 2018). Monitoring of the fisheries is conducted using information reported to the Secretariat in real time during the fishing season, and furthermore

the status and management of the fisheries is reviewed annually by the Scientific Committee (CCAMLR, 2018).

Not all fishing activities are prohibited within the MPA, there are some exceptions. Beginning with the 2020/21 fishing season, Members are permitted to directly fish for *Dissostichus* spp. in the SRZ in accordance with *Limits on the Exploratory Fishery for Dissostichus mawsoni in Statistical Subarea 88.1 in the 2017/18 season* (CM 41-09, 2017) subject to conditions including restricted base catch limits. Members are also permitted to conduct directed fishing for Antarctic krill (*Euphausia superba)* in the Krill Research Zone and the Special Research Zone in accordance with *General Measure for Exploratory Fisheries for Euphausia superba in the Convention Area in the 2017/18 season* (CM 51-04, 2017) and the specific objectives of this MPA (CM 91-05, 2016). Fishing vessels and vessels conducting scientific research on Antarctic marine living resources are expected to avoid dumping and discharging of wastes within the MPA. With the exception of emergencies and search and rescue operations, no fishing vessel may engage in transhipment activities within the MPA (CM 91-05, 2016).

Compliance, provisions and monitoring – how will fishing regulations be managed?

The Contracting Parties (both Members and Acceding States) are required to provide a copy of this CM to all licenced fishing vessels the CAMLR Convention Area (CM 91-05, 2016). Furthermore, Members that participate in the CCAMLR System of Inspection are encouraged to conduct surveillance and inspection activities within the MPA to validate compliance with this CM and other applicable measures (CM 91-05, 2016). In regards to traffic monitoring within the MPA, Flag States are required to notify the Secretariat before entering the MPA in their fishing vessels (CM 91-05, 2016). Moreover, vessels that conduct scientific research activities on Antarctic marine living resources are encouraged to notify the Secretariat of their plans in the MPA, including details of the vessel (CM 91-05, 2016).

Targeted fishing for *Dissostichus spp.* in Statistical Subarea 88.1 and SSRUs 882A-B are required to only be conducted in accordance with *Limits on the exploratory fishery for Dissostichus mawsoni in Statistical Subarea 88.1 in the 2017/18 season* (CM 41-09, 2017), and *Limits on the exploratory fishery for Dissostichus mawsoni in Statistical Subarea 88.2 in the 2017/18 season* (CM 41-10, 2017), subject to the provisions of this CM (CM 91-05, 2016).
Antarctic toothfish, *Dissostichus* spp. caught in the Special Research are required to be tagged and released at a rate of at least three fish per tonne of green weight caught. Tagging is conducted using pop up or implanted archival tags deployed based on advice from the Scientific Committee (CM 91-05, 2016).

All areas outside the MPA and within Statistical Sub and SSRUs, (including areas that currently have zero catch limits) will be opened (CM 91-05, 2016). Conservation Measures 41-09 and 41-10 (2017) are required to be revised for the 2017/18, 2018/19 and 2019/20 fishing seasons, and the total catch limit will be fixed at a level within the range of 2 583 to 3

157 tonnes per fishing season, based on advice from the Scientific Committee in 2017, 2018 and 2019 (CM 91-05, 2016).

Furthermore, " all areas outside the MPA and north of 70 ° will be open and the catch limit in these areas shall be fixed at 19% of the total; all areas outside the MPA and south of 70 south shall be open and the catch limit in these areas shall be fixed at 66% of the total; and the catch limit in the Special Research Zone shall be fixed at 15% of the total" (CM 91-05, 2016). Beginning with the 2020/21 fishing season, catch limits in CM 41-09 are required to be revised on the basis of advice from the Scientific Committee which is consistent with the MPA objectives and provisions (CM 91-05, 2016).

Success of a MPA

For a successful MPA, an appropriate management plan, monitoring and research plan, suggestions for improvement is required. Looking more closely at what the Ross Sea MPA management plan consist of, the objectives of the Ross Sea MPA encompasses three main categories:

Representativeness

"Research and monitoring to assess whether the MPA is protecting an adequate proportion of all benthic and pelagic environments in the Ross Sea region (CM 91-05, 2016)."

Threat mitigation

"Research and monitoring to assess the extent to which threats to the achievement of Article II.3 and the specific objectives of this MPA are being effectively avoided or mitigated by the MPA, in locations where the risk of ecosystem impacts from harvesting activities may otherwise be high (CM 91-05, 2016)."

Scientific references areas

"Research and monitoring where the MPA provides opportunities to examine Antarctic marine ecosystems where no or limited fishing has taken or is taking place, to understand, for example, the effects of fishing, environmental variability and climate change on Antarctic marine living resources (CM 91-05, 2016).
Furthermore, the MPA aims to contribute to the following specific objectives (in line with Article II of the CAMLR Convention):

"(i) to conserve natural ecological structure, dynamics and function throughout the Ross Sea region at all levels of biological organisation, by protecting habitats that are important to native mammals, birds, fishes and invertebrates;

(ii) to provide reference areas for monitoring natural variability and long-term change, and a Special Research Zone, in which fishing is limited to better gauge the ecosystem effects of climate change and fishing, to provide other opportunities for better understanding the Antarctic marine ecosystem, to underpin the Antarctic toothfish stock assessment by contributing to a robust tagging

program, and to improve understanding of toothfish distribution and movement within the Ross Sea region;

(iii) to promote research and other scientific activities (including monitoring) focused on marine living resources;

(iv) to conserve biodiversity by protecting representative portions of benthic and pelagic marine environments in areas where fewer data exist to define more specific protection objectives;

(v) to protect large-scale ecosystem processes responsible for the productivity and functional integrity of the ecosystem;

(vi) to protect core distributions of trophically dominant pelagic prey species;

(vii) to protect core foraging areas for land-based top predators or those that may experience direct trophic competition from fisheries;

(viii) to protect coastal locations of particular ecological importance;

(ix) to protect areas of importance in the life cycle of Antarctic toothfish;

(x) to protect known rare or vulnerable benthic habitats; and

(xi) to promote research and scientific understanding of krill, including in the Krill Research Zone in the north-western Ross Sea region (CM 91-05, 2016)."

MPA Management Plan provisions

In addition to the specific objectives of the overall MPA, the Management Plan of the Ross Sea MPA provides further details about the features or areas within the Ross Sea region MPA, and the management measures and administrative arrangements for achieving them. (CM 91-05, 2016)

The Ross Sea region MPA includes three zones (**Figure 1)** that are designed to achieve specific protection and scientific objectives while allowing some fishing to occur within the MPA.

General Protection Zone (GPZ)

"Designed to provide representative protection of different habitats and bioregions, to mitigate to eliminate many specifically identified potential ecosystem threats from fishing and to support existing and future scientific research and monitoring. All research fishing activities within the GPZ shall be conducted in accordance with *The Application of Conservation Measures to Scientific Research (*CM 24-01, 2017) and shall be consistent with the specific objectives of the MPA (CM 91-05, 2016)"

Special Research Zone (SRZ)

"In addition to contributing to representative protection and specific pelagic protection objectives, includes an important fishing area on the continental slope and is designed to serve as a scientific reference area to advance research to increase scientific understanding about the ecosystem effects of external forces like fishing and climate change and continue to inform the science-based management of the Ross Sea tooth fishery(CM 91-05, 2016)."

Krill Research Zone (KRZ)

"Designed to investigate life history hypotheses, biological parameters, ecological relationships and variations in biomass and production of Antarctic krill.
These are designed to achieve specific protection and scientific objectives while allowing some fishing to occur within the MPA. Within the KRZ, all research fishing for all species except krill shall be conducted in accordance with CM 24-01 and shall be consistent with the specific objectives of the MPA (CM 91-05, 2016)."

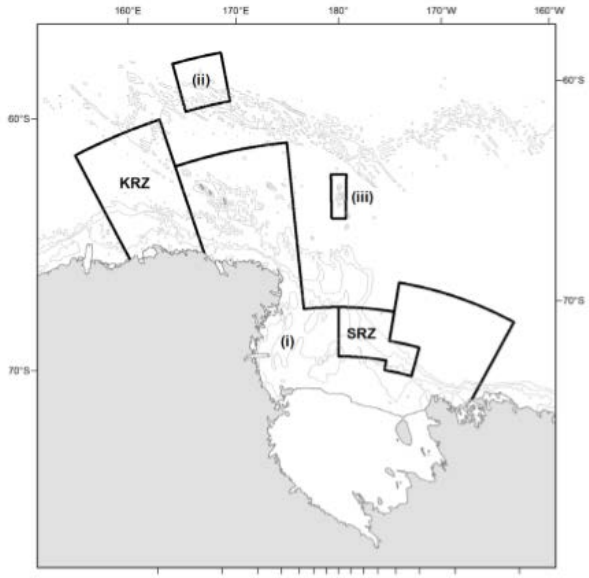

Figure 1: The Ross Sea region MPA including the boundaries of the General Protection Zone, composed of areas (i), (ii), and (iii), the Special Research Zone (SRZ), and the Krill Research Zone (KRZ) (CM 91-05, 2016).

The Scientific Research and Monitoring Plan (SRMP) will be organised geographically:

- "Ross sea continental shelf
- Ross Sea continental slope
- Balleny Islands and vicinity
- Northern Ross Sea region and seamounts
- Northwest Ross Sea region (CM 91-05, 2016)"

Period of MPA designation

On December 1st 2017, the Ross Sea gained recognition of the world's largest Marine Protected Area for a course of 35 years, and hence the period of this CM is 35 years, with some exceptions regarding fishing of the Antarctic toothfish *(Dissostichus* spp.) and Antarctic krill *(Euphausia superba)* mentioned above.

The Commission is required to review this CM at least every ten years to evaluate whether the specific objectives of this MPA are still relevant or being achieved (CM 91-05, 2016). If the Commission fails to reach consensus to reaffirm or modify this MPA, or adopt a new MPA at the 2052 meeting, this CM will expire at the end of the 2051/52 fishing season (CM 91-05, 2016).

Collaboration between Members, why is it important?

CCAMLR Members are required to submit a report on their activities conducted in the Ross Sea region every five years to the Secretariat, which will be reviewed by the Scientific Committee (CM 91-05, 2016). These activities may include any preliminary results and are accorded to or related to the MPA Research and Monitoring Plan. The Secretariat is required to compile the reports, provide them to the Scientific Committee in time for its annual meeting in 2022 (and every five years thereafter), and made available to Members on the CCAMLR website for data access (CM 91-05, 2016).

Members are encouraged to work together to actively engage:

- "the International Maritime Organisation with regard to ship traffic, vessel safety, and environmental protection issues, and other international organisations,
- to facilitate updates of the SRMP, Members should collaborate to provide baseline data, measurable criteria and indicators of the performance of the MPA, and data on present or future threats to achieving the objectives of the MPA,
- priority elements for scientific research and monitoring associated with the Ross Sea region MPA where members are encouraged to collaborate and repeat the types of activities identified.
- Members undertaking research and monitoring should invite the participation of other members in such activities, including field activities, data analysis and publication of research findings. (CM 91-05, 2016)."

Scientific Research

The Scientific Research and Monitoring Plan (SRMP) is an open, transparent and standardised framework which all Members interested are to collect data for assessment and analysis, which will the be used to evaluate the effectiveness of the MPA (CM 91-05, 2016). Some interesting questions to consider in regards to research and monitoring in accordance with the SRMP include:

- "Do the MPA boundaries continue to adequately encompass the priority populations, features and areas included pursuant of the MPA objectives?

- What are the ecosystem roles of the identified habitats, processes, populations, life-history stages, or other priority features?
- How are the priority features potentially affected by fishing, climate change, environmental variability, or other impacts?
- Does the structure and function of the marine ecosystem differ between areas inside the MPA and areas outside the MPA, or do the populations or sub populations of marine organisms that occur or forage inside the MPA differ from those that occur or forage outside the MPA? (CM 91-05, 2016)."

Conclusion

The Ross Sea is an extremely ecologically important area that provides habitat to a unique range of Antarctic species, hence the region is therefore of high conservation priority. The establishment of the Ross Sea Marine Protected Area (MPA) and its associated Management Plan and Conservation Measures aim to assist in this conservation, with the development og many management strategies and conservation practises. However, such measures need to be maintained and practised appropriately to ensure ongoing protection. Current monitoring needs to be evaluated more frequently, and further suggestions and recommendations for management should be considered for the next 35 years of the MPA duration. In conclusion, The Ross Sea MPA is relatively successful in terms of the provisions and zones established for ecosystem and species protection, however more research and stronger enforcement needs to be considered.

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